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E T U O I K E U S T O D I S T U S
P R I O R I T Y D O C U M E N T

Hakija Applicant	**Nokia Telecommunications Oy** **Helsinki**
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Keksinnön nimitys
Title of invention

"Depositing"
(Tallentaminen)

Hakijan nimi on hakemusdiaariin **05.12.1999** tehdyn nimenmuutoksen jälkeen **Nokia Networks Oy.**

The application has according to an entry made in the register of patent applications on **05.12.1999** with the name changed into **Nokia Networks Oy.**

Täten todistetaan, että oheiset asiakirjat ovat tarkkoja jäljennöksiä patentti- ja rekisterihallitukselle alkuaan annetuista selityksestä, patenttivaatimuksista, tiivistelmästä ja piirustuksista.

This is to certify that the annexed documents are true copies of the description, claims, abstract and drawings originally filed with the Finnish Patent Office.

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Depositing

Background of the invention

The present invention relates to method and equipment for updating amount of available credit to prepaid subscribers.

In mobile communications systems, such as GSM, use of prepaid SIM (Subscriber Identity Module) cards is increasing. Prepaid SIM cards relieve the network operators of credit losses. They enable parents to set an upper limit for the telephone bill beforehand. As a third benefit, they enable roaming subscribers to pay their local calls with local tariffs, whereas using the SIM card of their home operator, results in paying international tariffs to their home network and back.

Some operators allow the subscribers to call an Interactive Voice Response (IVR) service through which the service subscribers can check their account balance and add more money to their accounts. Account balance is also called credit. Money is added by means of vouchers. Some of the operators sell different types of vouchers, which differ from each other e.g. in the price of a "call unit".

A problem with the current IVR solution is that it does not support the change of voucher type. When a subscriber is adding money to his/her account, the value of the voucher is added to his/her current credit. That is not a problem, when the previous voucher and the new voucher are of same type. If the vouchers are of different types, the value of the voucher should not be added to the current credit because properties of call units differ. For that reason each night a dedicated person has to look through the database and find out all subscribers, who have changed their type of voucher, and update credits of said subscribers. A problem with this method is that it is slow, susceptible to errors and laborious. Furthermore, a subscriber, who has changed his/her voucher type, may get wrong answer when asking his/her credit before this manually done updating.

Disclosure of the invention

The object of the invention is to overcome the above stated problems. The object of the invention is achieved with a method, an arrangement and a network element which are characterized in that which is disclosed in the independent claims. The preferred embodiments of the invention are set forth in the dependent claims.

The invention is based on maintaining information about types of vouchers, comparing the type of a deposit voucher with the type of a last used voucher and selecting the way to deposit depending on the result of the comparison.

The advantages of the invention are that the credit is always automatically updated correctly and no amendments are needed afterwards. Thus the change of subscription type is very easy for prepaid subscribers and operators. Besides, the subscriber will get the amount of his/her current credit as it really is right after the depositing.

In one embodiment of the invention, when the vouchers are of different type, the credit is updated to be the value of the new voucher only. The further advantage of this embodiment is that it is a simple way to update the credit, when the type of the voucher changes.

Yet in one embodiment of the invention, when the vouchers are of different type, the credit is updated by multiplying the current credit with a factor, which value is determined on the basis of the voucher types, and the credit after depositing is the sum of the result of the multiplication and the value of the new voucher. The further advantage of this embodiment is, that the operator can offer flexible way to change the voucher type so that the current credit need not to be deleted totally, but may be adjusted to the new voucher type.

Yet in another embodiment of the invention the system asks the subscriber, whether he/she approves losing his/her current credit or part of it while doing the profile change. The further advantage of this embodiment is that the subscriber changing the voucher type must no more remember, that the unused credit will be lost, or was his/her last voucher of the same type. Besides he/she can deny the change of type, thus saving his/her old credit. This embodiment actually protects the subscriber.

Brief description of the figures

The invention will be described in further detail in the following by means of preferred embodiments with reference to the accompanying drawings, in which

Figure 1 is a block diagram showing some relevant network elements;

Figure 2 is a flow chart illustrating the first preferred embodiment;

Figure 3 is a flow chart illustrating the second preferred embodiment; and

Figure 4 is a functional model illustrating change of information between different network elements.

Detailed description of the invention

Figure 1 is a block diagram of a telecommunications system equipped with an arrangement according to a preferred embodiment of the invention. The telecommunications network is assumed to be a public land mobile network PLMN yet without limiting the invention to that kind of particular network. The invention can be used in any telecommunication systems, where the Prepaid subscribers can add money to their account. This embodiment illustrated in figure 1 makes use of Intelligent Network technology. An intelligent network (IN) is able to provide a subscriber of a telecommunications network, such as a wired network or a mobile telephone network, with a plurality of various services. An example of such an intelligent network is described in recommendations of the ITU-T Q-1200 series, of which Q-1210 to Q-1219 define a set of features known as CS-1 (Capability Set 1), and correspondingly, Q-1220 to Q-1229 define a set of features CS-2. The invention and its background will be described by the terminology of recommendation ETS 300 374-1 CorelNAP, but the invention can also be employed in intelligent networks implemented according to other intelligent network standards.

Figure 1 shows some elements of an intelligent network which are relevant to the understanding of the invention, such as specialized resource function SRF is an interface for network mechanisms associated with interaction with a subscriber. It can be associated with what are known as intelligent peripherals IP and comprise e.g. more advanced speech handling functions than do exchanges in general. The IVR application locates normally in the IP. The IVR application, also called as the PrePaid SIM IVR application, is an interactive voice response application that allows the subscriber to add money (deposit) PrePaid SIM accounts by entering the number of a prepaid voucher. The IVR application is later called simple the IVR. The IVR Voicetek Generation may be used as an execution environment for the IVR.

The IP is connected to a SSP using for example ISUP (ISDN User Part) signalling and one or more voice transports. The SSP (Service Switching Point) is a network element performing service switching function (SSF). The SSP may be a mobile service switching centre MSC, which includes SSF. The

SSF is an interface between a conventional call control function CCF and the service control function SCF of intelligent network. The network element performing the SCF is called a service control point (SCP). An intelligent network service is produced by the service switching point SSP inquiring instructions from the service control point SCP by means of messages to be transmitted across the SSP/SCP interface upon the encounter of detection points associated with the services. In association with an intelligent network service, a service program is started at the service control point SCP, the operation of the program determining the messages transmitted by the SCP to the SSP at each stage of a call. However, usually the SCP is not used in the service logic of the Prepaid SIM IVR application, i.e. calls to the IVR are routed directly to the IVR on basis of the service number by CCF.

In this example illustrated in figure 1, the prepaid subscriber specific information and information about vouchers are in a database located in a service management point SMP. Alternatively the information may be located in different databases and/or in some other network element. The subscriber specific information according to the invention comprises at least current credit. It may also comprise information from which the type of the last used voucher can be resolved. The subscriber specific information may also comprise information concerning time when the type of a voucher was last changed. The information about vouchers comprises the numbers of valid vouchers and their value. The information about vouchers may also comprise information about the voucher types. Alternatively the information about last used voucher can be saved in the voucher information for example by marking the voucher used by adding information about subscriber to the specific voucher information. The SMP may also comprise a log file, which includes the amount of deleted credit along with sufficient information to identify the subscriber and advantageously the time when the deletion was done. The log file may also be in an external database. The IVR interfaces the SMP database through service management interface SMI. The SMP and the IP may be connected e.g. through local area network (LAN) using TCP/IP (Transmission Control Protocol/Internet Protocol). The connection between IP and SMP illustrated by a dashed line represents only management connection without any signalling connection.

The present invention can be implemented to the existing network elements. They all have processors and memory with which the inventive

functionality described below may be implemented. The functions described below may be located in one network element or some of them may be in one element and the others in other elements regardless how they are located in the examples used to illustrate the invention.

Figure 2 is a flow chart illustrating functionality of the IVR in a first preferred embodiment of the invention. In this example it is assumed for the sake of clarity, that the new voucher is valid and all needed information will be got. It is also assumed, that in a case of subscription change, e.g. the voucher types are not same, the current credit is removed/deleted (set to zero). In the first preferred embodiment of the invention the voucher identification numbers are used to identify the type of the voucher so that e.g. when two types of vouchers are used, the identification numbers on list 1 are of type 1 and the missing numbers are of type 2. In some other embodiments every type can have their own type lists or e.g. the first two numbers of the identification number indicates the type of the voucher. Although it is essential to determine the type of the voucher, it is, however, irrelevant for the invention, how the type of the voucher is determined.

Referring to figure 2 a subscriber has bought a voucher from a shop, called to the IVR and selected to deposit the voucher. The subscriber is assumed to be a prepaid subscriber, otherwise he/she can not deposit. It is assumed, that the IVR checks at the beginning of the call, is the caller a prepaid subscriber, and if he/she is not, then the call is disconnected or connected to customer service. Figure 2 begins in step 201, where the IVR is prompting the subscriber for voucher identification ID. The voucher identification number ID2 is received in step 202. The validity of the voucher is checked (not shown in figure 2) and after that in step 203 the IVR gets the value V of the voucher. After that it is checked in step 204, has this subscriber made any deposits before. If the subscriber has done deposits before, the IVR gets the subscriber's current credit in step 205. The IVR also gets the identification number ID1 of the last used voucher in step 206 and determines the types of the vouchers in step 207 by using the identification numbers and going through list(s) in order to find out the types.

After the voucher types are determined, the IVR checks in step 208 are the vouchers of same type. If they are not, the subscriber is going to make subscription change, that is change the type of the voucher. Since in the first preferred embodiment of the invention the operator does not want the sub-

scriber to change type of voucher more than once in a day, the IVR will next get the date when the type of voucher was last changed in step 209 and check is the date the date of this updating day. If it is not, the change is allowable. In some other embodiments there may be different rules or a rule to determine if the change is allowable and the determination is done according the above stated adapting it to requirements of the rule(s). One example for that kind of a rule is that change of profile is allowed only on those days when the subscriber has not yet deposit anything. Another example is that deposit must be followed by a charged call before a new deposit can be made. This last rule may count also for normal deposits without change of type.

If the change is allowable (step 209), the IVR prompts for permission to change the type in step 210. With this prompting the subscriber is told his/her current credit, and also remind that he/she has bought a voucher of other type and therefore the current credit will be lost, if he/she wants to carry on depositing. Last the subscriber is prompt to give either a permission to continue or a discontinue sign. In some other embodiment of the invention it can be checked is the credit zero before doing step 211, and if the credit is zero, skipping over step 211.

If the permission is received in step 212, the log file is updated in step 213 by adding the information about the amount of deleted credit, whose credit it was, when it was deleted and what was the type. In this example the current credit is deleted when the type is changed. After that the IVR sets the value V of the voucher to be the current credit in step 214 and sets the last changed date to be that day in step 215. After that the IVR continues according to prior art by marking the voucher ID2 used in step 216, getting the credit in step 217 and prompting the credit in 218. The voucher is marked used in step 216 by adding subscriber information to the voucher identification number and giving "used date" the date of depositing in this first preferred embodiment.

If the subscriber does not want to loose the current credit, permission is not received in step 212 and the IVR quits without doing any updating and prompts goodbye in step 219. The call is disconnected.

If the date when the type of voucher was last changed is the date of this updating day (step 210), the IVR prompts that updating is not allowed today in step 220 and continues in step 219 by prompting goodbye.

If the vouchers are of same type (step 208), the IVR sets the credit to be a sum of current credit and the value V of the voucher in step 221 and then continue in step 216 by marking the voucher used as described earlier.

If the subscriber has not made any deposits before (step 204), his/her credit is zero and the IVR goes directly to step 214 by setting the credit to be the value V of the voucher as described earlier.

Figure 3 is a flow chart illustrating a function of the IVR application in a second preferred embodiment of the invention. Also in this example it is assumed for the sake of clarity, that the new voucher is valid, all needed information will be got and the calling subscriber is a prepaid subscriber. In the second preferred embodiment of the invention the first number of voucher identification number is used to identify the type of the voucher.

Figure 3 begins from same step as figure 2: a subscriber has bought a voucher from a shop, called to the IVR and selected to deposit the voucher and in step 301 the IVR is prompting the subscriber for voucher identification ID. The voucher identification number ID2 is received in step 302 and the type T2 of the voucher is determined from the first number of the ID2 in step 303. The validity of the voucher is checked (not shown in figure 3) and after that in step 304 the IVR gets the value V of the voucher as is described with figure 2. After that the IVR gets the subscriber's current credit in step 305 and the last used voucher type T1 in step 306. On the basis of the types T1 and T2 the IVR selects the updating way in step 307. If the type T1 was not found in step 306 and the current credit was also not found in step 305, the subscriber has never deposits and his/her credit is set to be the value V of the voucher in step 308A. If the vouchers are of same type (that is T1=T2), the value V of the voucher is added to the current credit C and the result is set to be the credit in step 308B. If the vouchers are of different type, the value of the factor F is determined in step 308C1, the current credit C is multiplied with the factor F, the outcome is added to the value V of the voucher and the result is set to be the credit in step 308C2. The value of the factor can always be zero, or if type T1 call units are expensive than type T2 call units, the value of the factor can be one, or if type T1 call units have half the price of type T2 call units, the value of the factor can be 0.5. The operator has freedom to predetermine the values of the factor for different combinations of T1 and T2. The invention does not limit the freedom, as long as there is at least one value of the factor determined when using this multiplying method.

After the credit is updated in one of the above described ways, the IVR sets the last used voucher type to be T2 in step 309. After that the IVR continues according to prior art by marking the voucher ID2 used in step 310.

The steps have not been set out in absolute time sequence in figures 2 and 3. Some of the above described steps may take place simultaneously or in different order or some of the steps can be skipped over, e.g. the step 210. It is also possible to add new steps not shown in figures, for example different prompts can be added to figure 3. It is also possible to combine steps from figure 2 and figure 3 when making a new embodiment. It is also possible, that when the IVR gets an incoming call, it checks whether the caller is a Prepaid subscriber, gets the current credit and prompts it, if the caller is a Prepaid subscriber or prompts an informative message, if the caller is not a subscriber. In these embodiments the steps 204 and 223 or 308A are not needed. Essential is, that the change in the voucher type is detected e.g. by comparing the types of the last used voucher and the new voucher and the selection of how to update the credit depends on whether the change is detected (e.g. is based on the result of the comparison).

The functional model of figure 4 is another way to illustrate the updating of subscriber's credit with a preferred embodiment of the invention. This figure does not illustrate actual signalling, since the communication between the IVR in the IP and the SMP is usually TCP/IP LAN via SMI. Besides there usually exits no signalling connection between the IP and the SMP. Also the communication between subscriber's mobile station and the IVR in the IP is by DTMF or voice. In this example, it will be assumed that updating the credit takes place under IN control, but this is not necessary to the invention. Another assumption, made here, is that the IN is also responsible for keeping track of the available credit of the prepaid SIM card. Yet another assumption, made here, is that the SCP does not control the calls to the IVR, since they are routed directly to the IP on the basis of the service number. It is also assumed, that the subscriber is a prepaid subscriber, who is going to make a subscription change, that is change the type of a voucher.

The scenario shown in the figure 4 begins when the subscriber has bought a new voucher and has called to the IVR, and sends an event 4-1 (deposit) to the IVR. The IVR asks the identification number of the voucher in an event 4-2 (get voucher id). The subscriber gives (by DTMF selection) the identification number of the voucher to the IVR in an event 4-3 (get voucher id

ack). Then the IVR asks from the SMP the value of the voucher in an event 4-4 (get voucher value). The SMP checks from its voucher related information the value of the voucher with the help of the identification number of the voucher it got in the event 4-4 and returns the value to the IVR in an event 4-5 (get voucher value ack). Then the IVR asks the SMP what was the identification number of last used voucher in an event 4-6 (get last used voucher). In some other embodiment the IVR may ask the type of the last used voucher. The SMP checks from its subscriber related information the identification number of the last used voucher and sends it in an event 4-7 (get last used voucher ack) to the IVR.

Then the IVR determines the types of last used voucher and new voucher from their identification numbers by going through list or lists with which the type can be determined. As stated before, it may also determine the type alternatively e.g. from the first number or first two numbers of the identification number. In the step 4-8 in the example illustrated in figure 4, the IVR compares the types of the vouchers and finds out, that the types of the vouchers differ from each other. So, the IVR is prompting to the subscriber, that his/her profile is changed and current credit is set to zero, if the subscriber accepts it, in an event 4-9 (accept deletion). In this example the subscriber will accept the deletion and sends an event 4-10 (deletion accepted) to the IVR. In a response to the accepting event 4-10, the IVR sends an event 4-11 (log profile change) to the SMP. This event includes preferably parameters which indicates the subscriber, what is the current credit, what was the last voucher type and the date. The event 4-11 may also include parameter indicating the new voucher type and/or its value. The SMP updates its log file with the information it got in the event 4-11 and sends an acknowledgement in an event 4-12 (log ack).

The IVR updates the credit to be the value of the voucher in step 4-13 and sends then the value to the SMP in an event 4-14 (set credit). The SMP sets the current credit to be the value it got in the event 4-14 into the subscriber related information and sends an acknowledgement in an event 4-15 (set credit ack). After that the IVR sends to the SMP an event 4-16 (mark used) telling it to mark the new voucher used. The SMP marks the voucher used in its voucher related information and sends an acknowledgement in an event 4-17 (mark used ack). Then the IVR sends an event 4-18 (disconnect) to the subscriber. After that the call is disconnected and the SMI connection to

the SMP is closed according to known procedures. In some other embodiment the IVR will first ask for credit from the SMP and prompt it to the subscriber before sending the event 4-18 (disconnect).

In some other embodiment the IVR may ask the type of the new voucher from the SMP and instead of asking the identification number in the event 4-6 ask the type of the last used voucher. The SMP could check its lists to determine the types of the vouchers on the grounds of the identification numbers and return the types to the IVR. Some other method to find out the voucher type may be used also.

If the event 4-10 is a "deletion not accepted" event, then after receiving it the IVR sends the event 4-18 (disconnect) to the subscriber instead of the event 4-11. Then no deposit is done, current credit before updating is not lost, neither the new voucher is marked used. Situation remains as if the call would dot have been done at all.

The events and the steps have not been set out in absolute time sequence in figure 4. Some of the above described steps and events may take place simultaneously or in different order, for example events 4-4 and 4-6. The events may include more information than what is stated above. The names of the events may differ form those set out above or the information needed according to the invention may be sent in other events as stated above. Also other events not shown in figure 4 may be sent or happen between events stated above.

Although in the above the invention is described with preferred embodiments using only one subscriber, it is obvious for one skilled in the art, that several depositing procedures may run in parallel as long as they are assigned unique channels so that the subscribers won't get mixed. Also other facilities than the credit updating may be updated and/or taking account when updating the credit although they are not described in detail here. One possible facility is the validity time given to a voucher.

The accompanying drawings and the description pertaining to them are only intended to illustrate the present invention. Different variations and modifications to the invention will be apparent to those skilled in the art, without departing from the scope and spirit of the invention defined in the appended claims.

Claims

1. A method for updating credit of a subscriber's account in a telecommunications system where at least two different types of vouchers can be used for depositing the account;

c h a r a c t e r i z e d by the method comprising the steps of:

defining at least two different ways of updating the credit (212, 222, 308);

maintaining information indicating the type of the first voucher currently used (206, 306);

receiving a deposit identifying a second voucher (202, 302);

determining the type of the second voucher(207, 303); and

selecting the way of updating the credit on the basis of the types of the first voucher and the second voucher (307, 208).

2. A method as claimed in claim 1, c h a r a c t e r i z e d by the method further comprising the steps of

checking whether the first voucher and second voucher are of the same type (208); and

updating the credit by adding the value of the second voucher to the credit (222), if said vouchers are of same type; or

updating the credit by setting the credit to be the value of the second voucher (214), if said vouchers are of different type.

3. A method as claimed in claim 1, c h a r a c t e r i z e d by the method further comprising the steps of

checking whether the first voucher and second voucher are of the same type (307); and

updating the credit by adding the value of the second voucher to the credit (308B), if said vouchers are of same type; or

determining a factor (308C1), multiplying the credit with the factor and adding the result of said multiplication to the value of the second voucher, and setting the credit to be the result (308C2) of said addition, if said vouchers are of different type.

4. A method as claimed in claim 3, c h a r a c t e r i z e d by determining said factor on the basis of the types of the first and second voucher.

5. A method as claimed in any one of the preceding claims, c h a r a c t e r i z e d by the method further comprising the steps of:

asking the subscriber a permission to update the credit, if the vouchers are of different type (211); and

updating the credit only if the permission is received from the subscriber.

6. A method as claimed in any one of the preceding claims, c h a r a c t e r i z e d by determining the types of the vouchers from their identification numbers.

7. A method as claimed in any one of the preceding claims, c h a r a c t e r i z e d in that the telecommunications system is a mobile telecommunications system.

8. An arrangement (IP, SMP) for updating credit of a subscriber's account in a telecommunications system, where subscribers can pre-pay for their calls by depositing their accounts via at least two different types of vouchers and where the credit is updated in a first way,

c h a r a c t e r i z e d in that the arrangement is adapted to:

detect a change of a voucher type (4-8) when the credit is updated;

in response to said detection, update the credit in a second way (4-13).

9. An arrangement as claimed in claim 8, c h a r a c t e r i z e d in that the arrangement is further in response to said detection adapted to ask the subscriber a permission to update the credit (4-9) and update the credit only in a response to the permission (4-10).

10. An arrangement as claimed in claim 8 or 9, c h a r a c t e r i z e d in that the arrangement is adapted to detect said change of voucher type (4-8) by determining types of a last used voucher and a new voucher and comparing these types.

11. An arrangement as claimed in claim 8, 9 or 10, c h a r a c t e r i z e d in that the arrangement comprises an Intelligent Peripheral (IP) of an Intelligent Network, said Intelligent Peripheral comprising an Interactive Voice Response (IVR) service through which the credits are updated.

12. A network element (IP) in a telecommunications system, where subscribers of the system can pre-pay for their calls by depositing their accounts via at least two different types of vouchers, which element includes a database or a connection to a database (SMP), where credits of the accounts are maintained,

c h a r a c t e r i z e d in that the

network element (IP) is arranged to determine types of subscriber's last used voucher and new voucher via which the subscriber is going to update his credit and to select a way of updating the credit among at least two different ways of updating on the basis of the types of said vouchers.

13. A network element as claimed in claim 12, c h a r a c t e r i z e d in that the network element (IP) is further arranged to ask the subscriber a permission to update the credit in a response to different types of said vouchers, and to update the credit only in a response to a received subscriber's permission.

14. A network element as claimed in claim 12 or 13, c h a r a c t e r i z e d in that the network element (IP) is further arranged to determine a factor in a response to different types of said vouchers and to multiply subscriber's current credit with said factor, to add the result of said multiplication to the value of the second voucher and to set the credit to be the result of said addition.

(57) Abstract

In order to make the change of subscription type easy for prepaid subscribers information indicating types of a last used voucher and a new voucher are maintained. With this information the types of said vouchers can be determined, change of subscription type detected and the right way to update the credit selected.

(Figure 3)

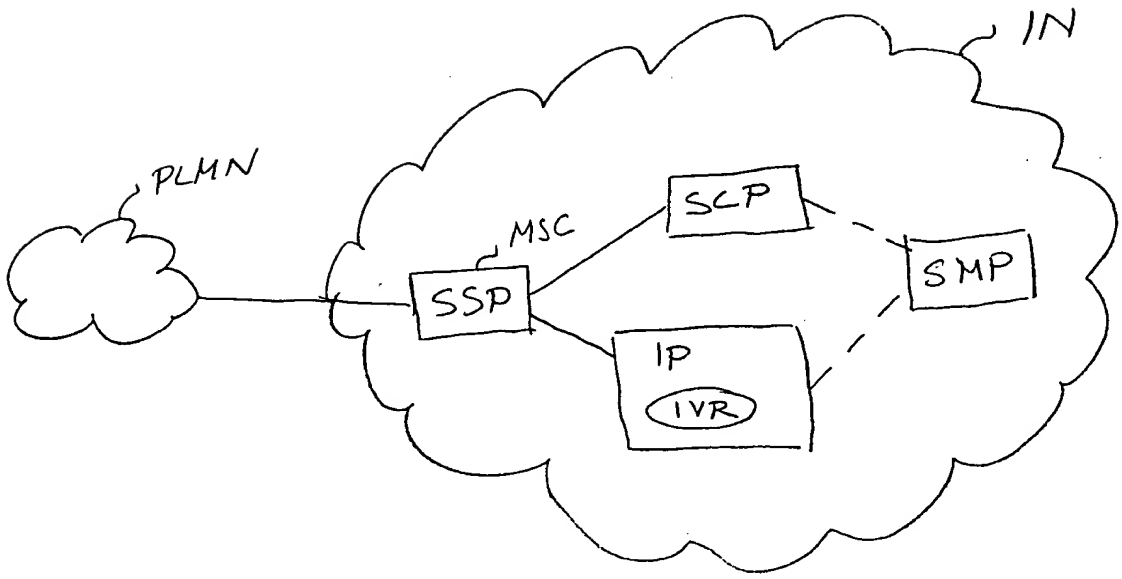


FIG 1.

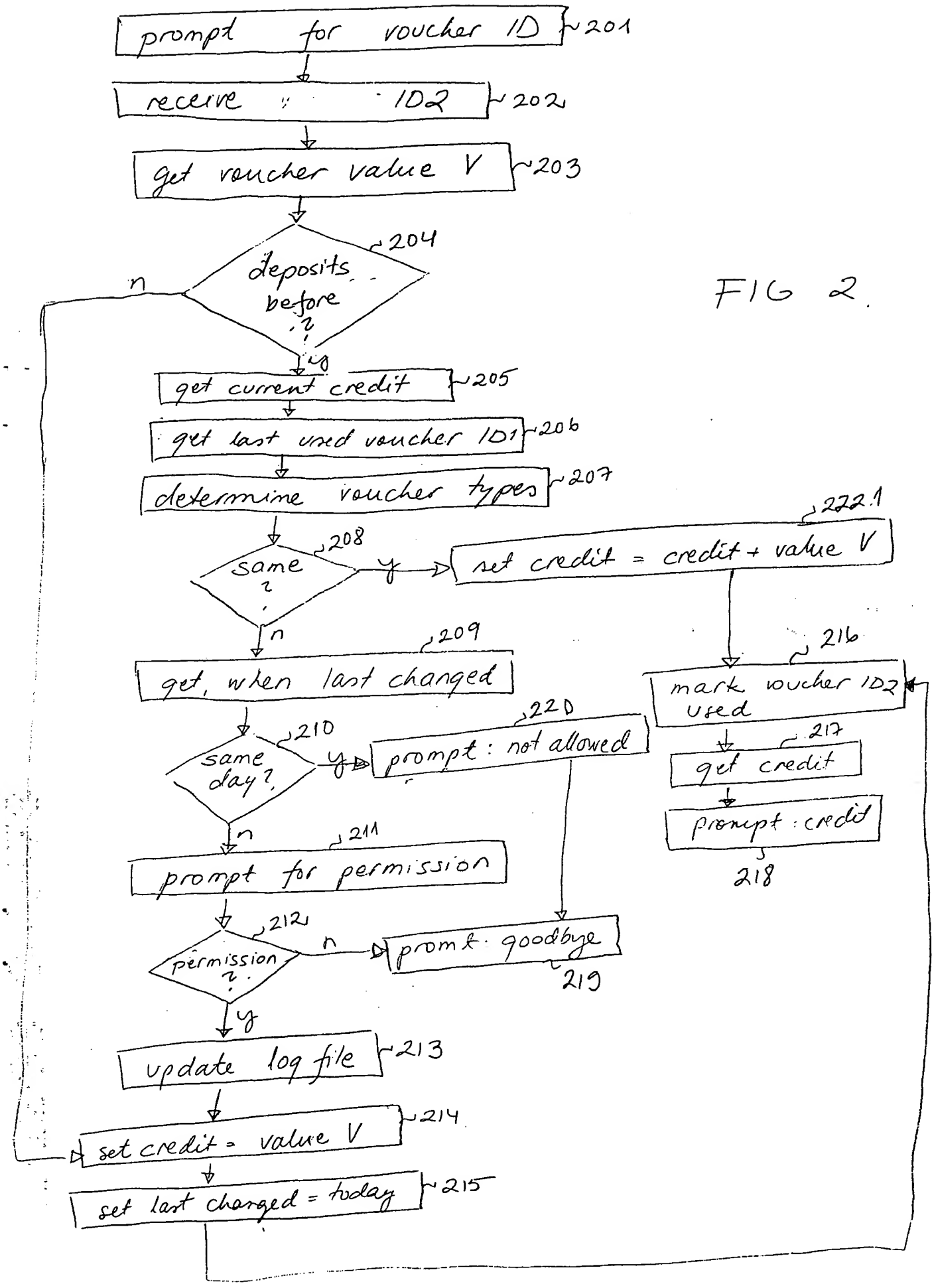

prompt for voucher ID
201
receive 102
202
get voucher value V
203
deposits before ?
204
n
y
get current credit
205
get last used voucher 101
206
determine voucher types
207
same ?
208
y
set credit = credit + value V
222.1
n
get, when last changed
209
mark voucher 102 used
216
same day ?
210
y
prompt: not allowed
220
get credit
217
prompt: credit
218
n
prompt for permission
211
permission ?
212
n
prompt: goodbye
219
y
update log file
213
set credit = value V
214
set last changed = today
215

FIG 2.

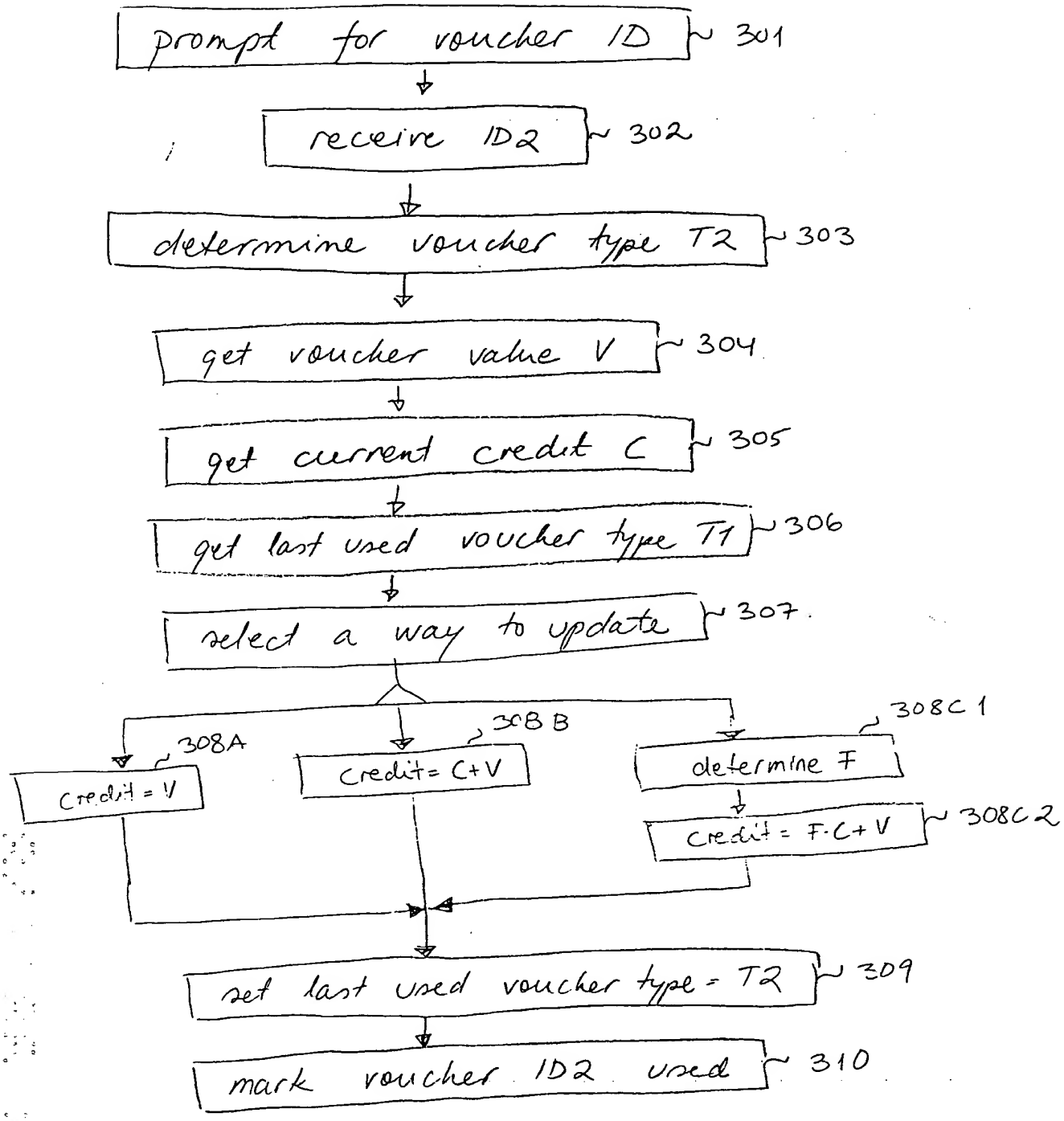
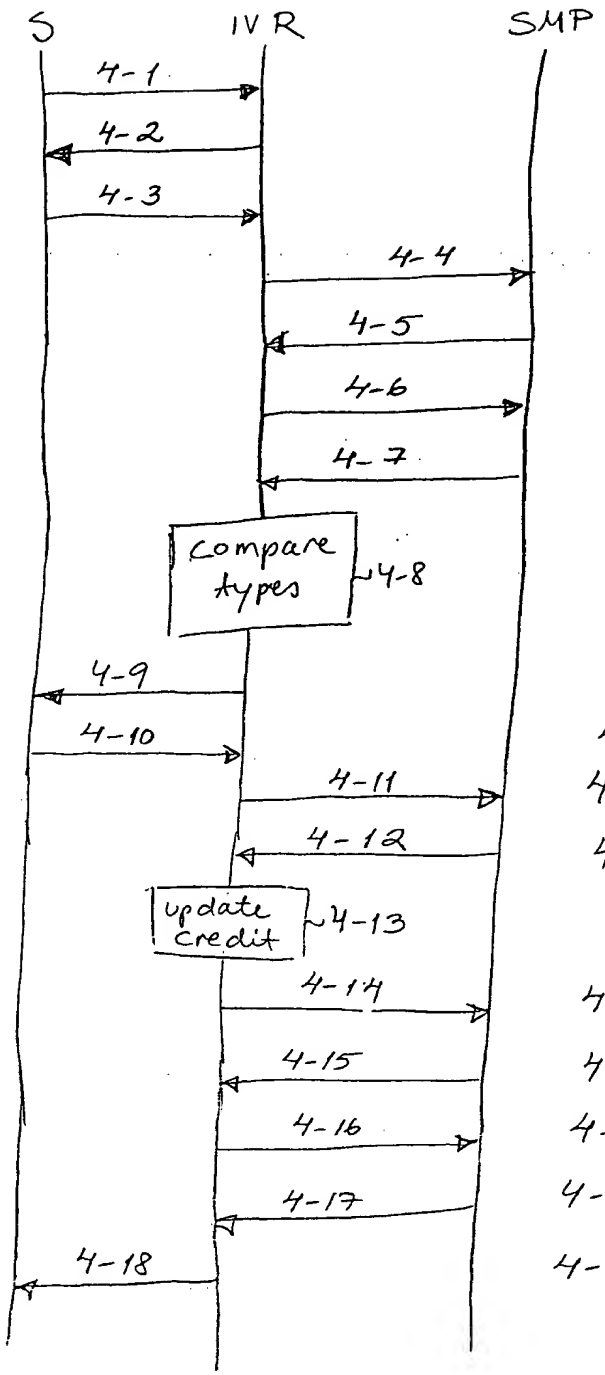

prompt for voucher ID
301
receive ID2
302
determine voucher type T2
303
get voucher value V
304
get current credit C
305
get last used voucher type T1
306
select a way to update
307
308A
Credit = V
308B
Credit = C+V
308C1
determine F
Credit = F·C+V
308C2
set last used voucher type = T2
309
mark voucher ID2 used
310

FIG 3



4-1. deposit
4-2. get voucher id
4-3. get voucher id ack
4-4. get voucher value
4-5. get voucher value ack
4-6. get last used voucher
4-7. get last used voucher ack

4-9. accept deletion
4-10. deletion accepted
4-11. log profile change
4-12. log ack

4-14. set credit
4-15. set credit ack
4-16. mark used
4-17. mark used ack
4-18. disconnect

FIG 4.